Fermilab

TECHNICAL DIVISION
POLICY 6020

RADIOACTIVE WASTE HANDLING REQUIREMENTS AND PROCEDURES

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide the State of Washington, the burial site operator, Fermi National Accelerator Laboratory, and other interested parties the assurance that radioactive waste generated within the Technical Division (TD) meets all burial site criteria for the proper disposal of radioactive waste, and it does not contain any hazardous materials or hazardous substances as defined by the Washington State Dangerous Waste Regulation (WAC-173-303).

TD makes every effort minimize the amount of radioactive waste and mixed waste generated as a result of work activities. This is accomplished by segregation of materials at waste generation sites; by separating non-radioactive material from radioactive materials; and by separating regulated materials from radioactive materials.

This document updates the previous Radioactive Waste Handling Program. TS-6020, dated April 1995.

1.2 Scope

The intent of this document is to provide TD personnel with information on how to implement the Fermilab Low-Level Waste Certification Program. The information contained in this document applies to all materials that become activated or contaminated due to the operation of the particle accelerator at Fermilab. This document provides guidance for proper segregation and waste minimization. It is not intended to provide instructions on the handling of hazardous waste and other type of waste unless there is an interaction with radioactive material that produces radioactive or mixed waste.

This document outlines the major requirements for the proper disposal of radioactive materials. Since it is impracticable to list all the burial site requirements in this document, users should contact the TD ES&H Group for guidance and approval if they anticipate generating a waste that is either prohibited or does not fall into any category found within this document.

1.3 Origin of the Requirements

The requirements outlined in this document are written with the intent of fulfilling all aspects of the WAC-173-303. An instrumental tool in meeting the WAC-173-303 is the proper use of the "Radioactive Waste Certification and Pickup Request Form" (Radiation Physics Form #31).

1.4 Definitions

Absorbed Radioactive Liquid Waste - absorbent material that contains radioactive liquid waste.

Approved Radioactive Waste Containers - container authorized for transporting radioactive waste from the pickup location to the ES&H Section Waste Facility. All containers listed in the table shown below are available through the ES&H Section or through the Fermilab stockroom. Stock numbers are indicated for those items available from the stockroom.

Table 1. Approved Containers for the Transportation of Radioactive Waste.

Dry Radioactive Waste	Liquid Radioactive Waste	Absorbed Liquid Radioactive Waste
55 gallon radioactive waste drum	30 gallon radioactive waste drums (drums are specifically designated for "water only" and "oil only")	Radioactive waste bags (sealed)
55 gallon Radioactive waste drum with large radioactive bag liners (for dry compactable)	5 gallon carboy (FNAL Stock #1640-2025)	
Pallet-used for large items. Items must be securely banded to the pallet and treated as a stand alone package	2 liter bottle (FNAL Stock #2540-0960)	
Radioactive steel waste bins	250 ml bottles (FNAL Stock #2540-0945)	
Designated radioactive waste vacuums certified by the ES&H Section		

Dry Radioactive Waste - radioactive waste that contains no free standing liquids or absorbed liquid waste.

Mixed Waste - radioactive waste that also contains hazardous materials as defined by the WAC-173-303.

Radioactive Waste Custodian - any person who is responsible for the contents of a radioactive waste container as indicated by their signature at the top of the "Radioactive Waste Certification/Pickup Form".

Radioactive Liquid Waste - radioactive waste in liquid form.

Radioactive Waste - any material, equipment or system component that has been identified as being radioactive due to exposure to the particle beams, or has been rendered contaminated (that is, to have removable radioactivity present on the surface) and whose economic value has been determined to be less than the cost of recovery of that particular item.

Stand-Alone Package - a single package used to contain radioactive waste that has been assigned its own package number as described in Attachment A.

2.0 RESPONSIBILITIES

2.1 Technical Division Department Head Shall:

1. Be responsible for ensuring that all requirements of this document are met for any activity within the their scope of work that generates radioactive waste.

2. Assign department Waste Custodians and ensure the TD Radiation Safety Officer (RSO) trains them.

3. Take prompt corrective action when notified of waste procedure violations discovered as a result of assessments or inspections.

2.2 Technical Division RSO Shall:

1. Train all TD Waste Custodians in the requirements of this program.

2. Coordinate the issuing of approved radioactive waste containers.

3. Review each submitted "Radioactive Waste Certification/Pickup Form."

4. Perform periodic reviews of TD waste generation sites to ensure that the requirements of this program are being met.

5. Accompany the ES&H Section on periodic inspections and audits of radioactive waste generation sites.

2.3 Technical Division Radioactive Waste Custodian Shall:

1. Ensure that generators properly characterize the waste prior to placing it in the radioactive waste container.

2. Maintain positive control over the containers assigned to them by keeping them locked or secured any time they are not present.

3. Maintain up-to-date "Radioactive Waste Certification/Pickup Forms" that reflect all items which have been place in their container(s).

4. Survey items at the generation site to ensure that they are radioactive prior to placing them in a radioactive waste container.

5. Properly characterize and document on the "Radioactive Waste Certification/Pickup Form " each item that is placed in a radioactive waste container

6. Complete and submit the "Radioactive Waste Certification/Pickup Form" to the TD RSO for review.

3.0 TRAINING & QUALIFICATIONS

3.1 General Requirements

1. All TD Radioactive Waste Custodians will receive TD Radioactive Waste Handling Program training from the TD RSO.

2. Plans and requests to hire contractors or use other non-TD employees for specific tasks that require work with radioactive materials shall be reviewed by the TD RSO to ensure that appropriate training and supervision are provided.

3.2 Training

1. The TD RSO provides Radioactive Waste Handling training for TD Radioactive Waste Custodians, consisting of the following:

   a. A review of the TD-6020, Radioactive Waste Handling Requirements and Procedures.

   b. The employee completes a written exam to demonstrate knowledge of TD radioactive waste handling requirements. The test results are reviewed with each employee.

2. Individuals who do not score a minimum grade of 70% correct are retrained in one of two ways.

   a. If the individual clearly has little or no knowledge of the “TD Radioactive Waste Handling Requirements and Procedures,” they will review the test with the TD RSO and be required to attend another training class.

   b. If there are small deficiencies in the employee's knowledge the TD RSO can complete remedial training through a test review with the trainee.

3. Upon successful completion of testing, the individual is considered to be qualified in radioactive waste handling and the training is entered into the Fermilab Safety Training database, TRAIN, under course number TD006020.

4.0 GENERAL REQUIREMENTS

4.1 Surveying Items

1. All materials must be surveyed prior to being placed in radioactive waste containers to ensure that they are indeed radioactive.

2. Radioactive waste materials need to be disposed promptly (i.e., at the end of a work shift) in an approved container as defined in Table 1 of this document.

3. Determining if items are radioactive:

   a. The decision whether items are radioactive will be based on the frisker count rate. Typical background count rates found on the frisker are about 30 to 50 cpm. Items are considered to be radioactive if they have a contact count rate of 50 cpm above background.

   b. Items are surveyed with a frisker on contact (1/4”-1/2”) and all surfaces of the item need to be surveyed. The item is scanned at a rate of 1”-2” per second.

NOTE: If the background count rate is greater than 100 counts per minute, suspect materials need to be taken to an area where the background count rate is at or below 50 counts per minute.

   c. With the exception of any oil waste and hazardous waste, all waste found to be **non**-radioactive is to be thrown away in trash cans or dumpsters.

4.2 Completing the Radioactive Waste Certification and Pickup Request Form

1. TD Waste Custodians are required to certify that the waste contains no hazardous materials at the time it is placed in a radioactive waste container. Care must be taken to ensure that characterization of items placed in radioactive waste containers is accurate and complete.

2. The description of the waste on the "Radioactive Waste Certification and Pickup Request Form" has a specific format that must be followed.

   a. The first criteria is that the description be understood by the TD Waste Custodian so that if asked to recall the material, the custodian can easily remember the item, for example, a "tie plate."

   b. Secondly, the description must also be meaningful to personnel at the burial site. The description "tie plate” has no meaning to the burial site operator but "plate, 100% steel" does.

c. For this example the complete description for entry on the “Radioactive Waste Certification and Pickup Request Form” should be "tie plate, (plate, 100% steel)"

4.3 Transportation of Radioactive Waste

1. Radioactive items being transported to approved waste containers should either be labeled with class tape or placed in radioactive waste bags. Radioactive materials shall **not** be transported in bags used for normal trash.

2. Radioactive waste items **cannot** be transported in personal vehicles.

4.4 Storage and Security of Radioactive Waste Containers

1. All radioactive waste containers are to be kept locked when unattended by the custodian.

   a. Fifty-five gallon barrels are issued with clevis pins, and thirty gallon barrels will be provided with drum locking devices. The person to whom a barrel is issued must provide the lock for the barrel.

   b. Other authorized containers shall be placed in locked cabinets or have equivalent measures administered to ensure positive control over their contents.

2. The radioactive waste container custodian shall assure that all items placed in the containers under their supervision are properly recorded and characterized at the time the items are placed in the container. A copy of the "Radioactive Waste Certification and Pickup Request Form" shall be maintained by the container custodian.

5.0 SPECIFIC REQUIREMENTS

5.1 Dry Radioactive Waste

1. **Dry** compactable waste such as shoe covers, gloves, other types of protective clothing, and dry rags that have not been exposed to solvents should be placed in barrels designated for compactable radioactive waste.

2. A large yellow plastic radioactive waste bag shall be used as a liner in the 55 gallon barrels.

3. No liquids of any type are to be placed in 55 gallon radioactive waste barrels. These barrels are to be used for dry radioactive waste only.

4. No hazardous materials such as lead or beryllium are to be disposed of in 55 gallon radioactive waste barrels.

5. Non-compactable waste such as contaminated lumber, structural steel, beam pipe, and other such materials are to be collected separately in 55 gallon drums.

6. Non-compactable radioactive waste items that are too large for 55 gallon barrels may be placed on wooden pallets and banded or otherwise secured to the pallet to prevent their loss while being transported. The pallet of material must be assigned a package number as described in Attachment A of this document.

7. Large quantities of materials such as steel structures from magnets waste may be collected in large steel boxes. Arrangements to obtain large steel boxes should be made in advance with the TD ES&H Group.

8. Radioactive waste bags, any type of radiological signs, and radioactive class tapes shall **never** be thrown away in normal trash cans or dumpsters. It is immaterial that such items are below the release criteria of 50 counts per minute above background. These materials will always be discarded as radioactive waste in radioactive waste barrels.

8. Some components to be disposed of may be coated with oils and grease. These items can only be disposed as radioactive waste if all visible traces of oil and grease are removed. Since the oil and grease are considered radioactive due to the possibility of containing tritium, rags that are used to clean these components need to be disposed of as outlined in Section 5.3 of these procedures.

5.2 Liquid Radioactive Waste

TD rarely deals with radioactive liquids; however, all fluids from radioactive components must be treated as if they are radioactive unless they can be determined not to be radioactive by direct sampling or process knowledge.

Water in main ring conventional magnets contains tritium that is below the limit of 2000 pCi/ml for surface water discharge, and therefore should not be considered radioactive. These magnets are also required to be flushed prior to being received by TD personnel.

Other types of magnets received from other sources will be reviewed by the TD RSO on a case-by-case basis to determine wastewater handling procedures.

1. Water and KPC-820N (FNAL Stock #1920-0705) are the only pre-approved solvents that may be used on radioactive materials. Contact the TD ES&H Group if these are not adequate solvents.

2. Oil removed from equipment, such as vacuum pumps and leak detectors, that have been exposed in beam enclosures may contain tritium. Tritium is not detectable with hand-held instruments. This oil must be collected in properly labeled and approved containers and treated as radioactive waste until sampling and analysis has determined otherwise.

3. The type of container permitted for the collection of liquid radioactive wastes are a:
    - 30-gallon radioactive waste drum
    - 5 gallon carboy
    - 250 ml to 2-liter polyethylene bottle

    The type of container used should be appropriate for the quantity of waste being collected. Large volume generators should use 30 gallon radioactive waste drums. Small quantities of oil or water from systems collected infrequently that are known to be radioactive may be collected in 5 gallon carboys or smaller polyethylene bottles.

4. All liquid radioactive waste containers must be protected against filling by persons other than the specific waste generator who owns the container.

5. All liquid radioactive waste containers must be protected against damage. Barrels and other containers need to be stored in such a manner that damage by vehicle and/or equipment movement is not possible.

6. Thirty gallon barrels are issued with a locking device. Smaller containers such as 5 gallon carboys or polyethylene bottles must be kept locked in cabinets or secured in a similar manner to assure that unauthorized filling of a container is not possible. (See Section 4.4.)

7. Thirty gallon barrels are issued specifically for either water or oil.

    a. No water may be added to oil waste barrels with the exception of incidental water that may be present in vacuum pumps as a result of operation of the pump.

    b. No oil shall be added to those barrels designated for water waste only.

8. A "Radioactive Waste Certification and Pickup Request Form" must be completed for each liquid radioactive waste container.

    a. The quantities and type of each oil added to an oil waste container must be indicated on the form.

    b. The person responsible for the container must ensure that all oils added to the container are acceptable.

    d. With the exception of certain oils, no halogenated or non-halogenated hydrocarbons of any kind are permitted to be disposed in radioactive waste liquid containers.

5.3 Absorbed Liquid Radioactive Waste

1. Rags and Kimwipes used with water to clean radioactive materials can be checked with a frisker and disposed as non-radioactive waste if their contact readings are found to be less than 50 cpm above background.

2. Potentially radioactive absorbed liquids of non-hazardous oils and water may **not** be collected together in a single bag. Absorbed oils and water must be collected separately as is the case in any liquid waste collection.

NOTE: If tritium is suspected, a sample of the liquid should be collected and sent to the Fermilab Counting Lab for analysis. Tritium cannot be measured with the hand-held instruments available in the TD**.**

3. Rags and Kimwipes used to wipe up oil spills from equipment exposed in beam enclosures or to clean up oily parts of components exposed in the beam enclosures are to be collected separately in yellow radioactive waste bags. Since a frisker will not detect the presence of tritium in the oil, assume the rags are radioactive until sampling and analysis or process knowledge has determined otherwise.

4. All radioactive waste bags used to collect wet rags must be collected as a stand-alone package and cannot be put into 55-gallon drums.

   a. A stand-alone package requires a separate "Radioactive Waste Certification and Pickup Request Form" with the type and name of the liquid included in the waste description.

   b. A package number must be generated for each bag as outlined in Attachment A of this document.

   c. Radioactive waste bags are **not** to be placed into radioactive waste barrels.

5.4 Mixed Radioactive Waste

1. Mixed radioactive wastes are those wastes that are both radioactive and contain hazardous materials as defined by Washington State Dangerous Waste Regulation (WAC-173-303).

2. Oils normally found at Fermilab such as vacuum pump oils and Shell Diala AX dielectric oils are **not** hazardous and are **not** mixed waste when they become radioactive. They are to be disposed as liquid radioactive waste as outlined in Section 5.2.

3. Below are some factors and guidelines that may be used in determining if materials are classified as hazardous:

a. Hazardous wastes have the characteristics of being ignitable, corrosive, reactive, persistent, carcinogenic, or toxic.

b. Typical hazardous waste produced at Fermilab are those containing ethyl alcohol, Freon, methanol, acetone, lead, and beryllium; these materials are not permitted to be disposed in radioactive waste containers.

c. Other materials prohibited for disposal in radioactive waste containers are acids, bases, salts (including NaCl or ordinary table salt), Simple Green, and certain synthetic oils.

d. If there is any **doubt** about whether a material is classified as a hazardous material, contact the TD ES&H Group **before** generating the waste.

4. In the case where mixed waste is generated, the TD ES&H Group must be consulted for packaging instructions and to aid in the completion of the "Hazardous/Radioactive Waste Certification and Pickup Request Form;" (Radiation Physics Form #71).

5.5 Material Prohibited For Use On Radioactive Materials

1. The use of solvents to clean radioactive material is generally forbidden. If it becomes necessary to clean radioactive components with hazardous materials, the TD ES&H Group must be contacted for prior approval.

2. Any other chemicals should only be used on radioactive materials if **prior** approval is received from the TD ES&H Group so that it can be determined if they are acceptable for burial in radioactive waste containers.

3. The items that are to be cleaned will need to be checked for loose surface contamination by the local radiation monitor or the TD RSO prior to use of the solvent. Approval for the use of the solvent is indicated on the survey form by the TD ES&H Group.

    a. If the part to be cleaned is found to be contaminated, the contamination shall be removed with water or KPC 820N.

    b. The rag or wipes used in this portion the procedure should be surveyed, and if radioactive, should be treated as absorbed radioactive liquid waste. (See Section 5.3.)

    c. After the part has been decontaminated and has been shown to be free of radioactive contamination, the part may be cleaned with an approved hazardous solvent such as ethyl alcohol, if necessary.

    d. Solvent laden rags or other wipers used in this portion the procedure will need to be collected as hazardous waste.

Guidance on how to complete the "Radioactive Waste Certification and Pickup Request Form."

Name (Print) and Signature:
First and last name printed and written legibly of the person who will be held accountable for the proper and complete characterization of the waste.

Date:
The date the certification form is signed.

Mail Station:
Fermilab mail station number where you would like a copy of the form sent after the package is picked up.

Package #:
The number on the "Radioactive Waste Label" that is assigned to 30 gal. drums, 55 gal. drums, and steel boxes, by Radiation Physics personnel when the containers are issued empty. The generator shall assign an inventory number to all bags of compactables, bulk items or any other type package that isn't assigned a number by Radiation Physics personnel, as follows: 901001JK01 - (90) year, (10) month, (01) day of the month, (JK) initials of the person assigning the number, (01) the first bag or item assigned a number that day. The number must be written on the package or item. If bulk items are palletized or banded together, one number may be assigned to each pallet or bundle.

Package Type:
55 gal. drum, 30 gal. drum, pallet, bulk, cardboard box (for fluorescent bulbs), bag, etc.

Gross Weight:
Gross weight = weight of container + waste weight.
Container weights: 30 gal. Drum = 30 lbs
55 gal. Drum = 50 lbs
HEPA Vacuum = 40 lbs
Steel Box = 280 lbs

Waste Volume: Volume of waste in cubic feet.
Container volumes: 30 gal. Drum = 4 ft^3
55 gal. drum = 7.4 ft^3
HEPA Vacuum = 3.0 ft^3
Steel Box = 56 ft^3.

Contact Dose Rate:
The highest contact dose rate on the package.

Isotopes:
List all isotopes that contribute to more than 1% of total activity. TD ES&H Group assistance may be necessary to complete this section of the form.

Activities:
The respective activities or specific activities for the above listed isotopes. TD ES&H Group assistance may be necessary to complete this section of the form.

Sample Numbers:
The respective sample numbers of the sample used to characterize the waste (if applicable).

Method of Assay:
Check the boxes that apply. Include the applicable analytical results.

Pickup Location:
The location where the waste was packaged or prepared for pickup.

Division/Section Review:
To be completed by TD ES&H Group.

Empty Pkg. Deliver; Qty; Type:
Enter quantity and type if empty packages are needed.

Pickup #; Pickup Date; By:
To be completed by the ES&H Section Radiation Physics Technical Support Group.

Date:
The date the item was placed into the package.

Description of Waste:
A complete description of the contents of the package must be entered on the form. If more than one type of oil is placed in a 30 gal. drum, enter the volume of each type (i.e., HE-150 pump oil, 10 gal.). Use as many forms as necessary for each package.

The description of the waste should include the proper name of the part, its physical form, and, its chemical form.

Examples of proper waste description

1. Kautzky Valve (solid, 49% stainless steel, 49% aluminum, 2% polypropylene)
2. Mineral oil absorbed on rags (absorbed liquid, 70% cotton cloth, 30% mineral oil)

Approx. Wt. in Lbs.:
Enter the item's approximate weight in pounds.

Signature of Waste Generator:
The person who generated the waste. By their signature, they are certifying that no dangerous wastes, as identified at the top of the form, are present in the item.

Disposition of Items:
To be completed by the ES&H Section Radiation Physics Technical Support Group